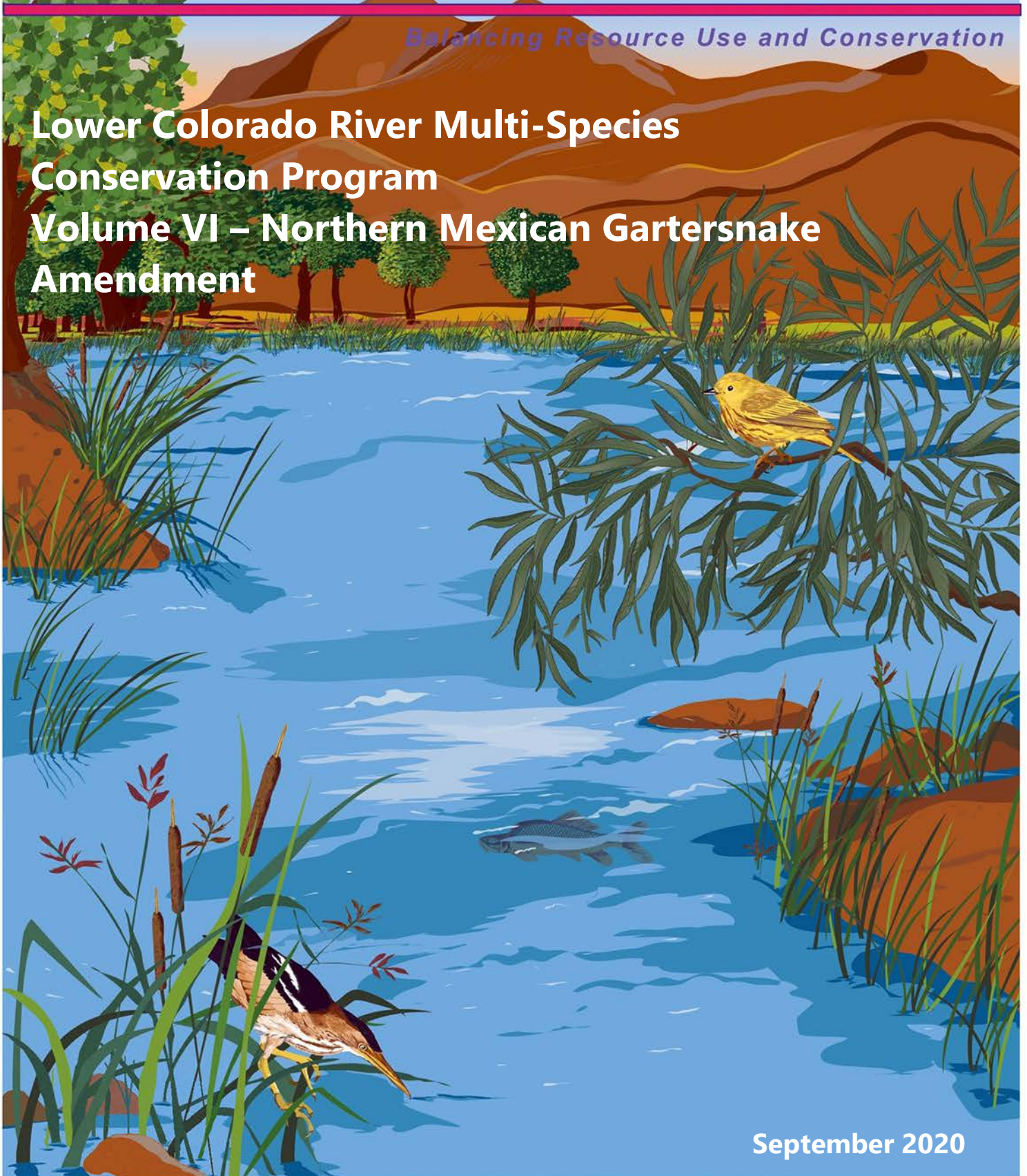




Lower Colorado River Multi-Species Conservation Program

Balancing Resource Use and Conservation

Lower Colorado River Multi-Species Conservation Program Volume VI – Northern Mexican Gartersnake Amendment



September 2020

Lower Colorado River Multi-Species Conservation Program Steering Committee Members

Federal Participant Group

Bureau of Reclamation
U.S. Fish and Wildlife Service
National Park Service
Bureau of Land Management
Bureau of Indian Affairs
Western Area Power Administration

Arizona Participant Group

Arizona Department of Water Resources
Arizona Electric Power Cooperative, Inc.
Arizona Game and Fish Department
Arizona Power Authority
Central Arizona Water Conservation District
Cibola Valley Irrigation and Drainage District
City of Bullhead City
City of Lake Havasu City
City of Mesa
City of Somerton
City of Yuma
Electrical District No. 3, Pinal County, Arizona
Golden Shores Water Conservation District
Mohave County Water Authority
Mohave Valley Irrigation and Drainage District
Mohave Water Conservation District
North Gila Valley Irrigation and Drainage District
Town of Fredonia
Town of Thatcher
Town of Wickenburg
Salt River Project Agricultural Improvement and Power District
Unit "B" Irrigation and Drainage District
Wellton-Mohawk Irrigation and Drainage District
Yuma County Water Users' Association
Yuma Irrigation District
Yuma Mesa Irrigation and Drainage District

Other Interested Parties Participant Group

QuadState Local Governments Authority
Desert Wildlife Unlimited

California Participant Group

California Department of Fish and Wildlife
City of Needles
Coachella Valley Water District
Colorado River Board of California
Bard Water District
Imperial Irrigation District
Los Angeles Department of Water and Power
Palo Verde Irrigation District
San Diego County Water Authority
Southern California Edison Company
Southern California Public Power Authority
The Metropolitan Water District of Southern California

Nevada Participant Group

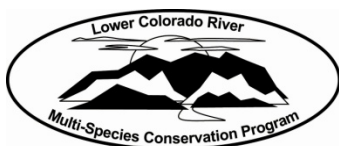
Colorado River Commission of Nevada
Nevada Department of Wildlife
Southern Nevada Water Authority
Colorado River Commission Power Users
Basic Water Company

Native American Participant Group

Hualapai Tribe
Colorado River Indian Tribes
Chemehuevi Indian Tribe

Conservation Participant Group

Ducks Unlimited
Lower Colorado River RC&D Area, Inc.
The Nature Conservancy



— BUREAU OF —
RECLAMATION

Lower Colorado River Multi-Species Conservation Program

Lower Colorado River Multi-Species Conservation Program Volume VI – Northern Mexican Gartersnake Amendment

**Lower Colorado River
Multi-Species Conservation Program
Bureau of Reclamation
Lower Colorado Basin
Boulder City, Nevada
<http://www.lcrmscp.gov>**

September 2020

Lower Colorado River Multi-Species Conservation Program. 2020. Lower Colorado River Multi-Species Conservation Program, Volume VI – Northern Mexican Gartersnake Amendment. Bureau of Reclamation, Boulder City, Nevada.

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Lower Colorado River Multi-Species Conservation Program

Appendix W – Final Habitat Conservation Plan Amendment
Addition of New Covered Species – Northern Mexican Gartersnake

Final Appendices to Volumes I-III and V
Volume IV

Background and Appendix Format

The northern Mexican gartersnake (*Thamnophis eques megalops*) was not considered for coverage during the 2005 development of the LCR MSCP Habitat Conservation Plan (HCP), because it was believed to be extirpated within the planning area. However based on a number of events, as described below, the LCR MSCP is now seeking to add the northern Mexican gartersnake to the list of covered species under the program.

- On July 10, 2013, the U. S. Fish and Wildlife Service (USFWS) published in the *Federal Register* a proposed rule to list the northern Mexican gartersnake as Threatened under the Endangered Species Act and a proposed rule for critical habitat designation (USFWS 2013a; USFWS 2013b). The final rule listing the northern Mexican gartersnake as Threatened under the Endangered Species Act was published on July 8, 2014 (USFWS 2014). Habitat identified for critical habitat was proposed on the Bill Williams River in Arizona (the proposed Bill Williams River Unit) within the LCR MSCP implementation area between Alamo Dam and the confluence of the Colorado River and Bill Williams River.
- In 2012, personnel of the Arizona Game and Fish Department (AGFD) discovered northern Mexican gartersnakes on the Bill Williams River in Arizona between Planet Ranch and Alamo Dam while conducting amphibian surveys. This portion of the Bill Williams River is within the LCR MSCP implementation area (Reach 3). In December 2015, the Planet Ranch Conservation Area was included in the program. The conservation area includes existing agricultural fields, the active floodplain of the Bill Williams River where flows are normally subsurface, and a portion of the Bill Williams River adjacent to the Bill Williams River National Wildlife Refuge where perennial surface water occurs. LCR MSCP habitat creation at Planet Ranch may result in creation of habitat that could be colonized by lowland leopard frogs and Colorado River toads, and now, northern Mexican gartersnakes.
- In 2015, a northern Mexican gartersnake was confirmed at the LCR MSCP's Beal Lake Conservation Area in the riparian field next to Willow Marsh on Havasu National Wildlife Refuge near Needles, California in LCR Reach 3. The Bureau of Reclamation (Reclamation) initiated a consultation with the USFWS for maintenance and infrastructure improvements at the Beal Lake Conservation Area and received a Biological Opinion in November 2015.

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- In addition to being listed as threatened under the federal Endangered Species Act, the northern Mexican gartersnake is also designated as an Arizona Species of Greatest Conservation Need. There is no special regulatory designation for the species in California or Nevada. It is considered extirpated in California.

Information about the northern Mexican gartersnake contained in the attachments to this appendix are formatted for the HCP. For example, Attachment 1 provides additional text appended to the end of Table 3-9 from the HCP. The format for the new information presented herein is an extension of the original HCP text.

Species Habitat Model

Covered species habitats had not been directly field delineated in the LCR MSCP planning area. Rather, species habitats were defined in the HCP by application of species habitat models based on the likelihood for each land cover type to support species habitat. For these species, the analysis of the extent of their habitat began with a definition of the land cover types used for the species models. The land cover type classification system used in the LCR MSCP was derived from previous classifications developed by Anderson and Ohmart (1976, 1984) and Younker and Anderson (1986). For riparian species, land cover types were classified by plant community and structural type. For marsh species, land cover types were classified by plant community and characteristics.

Attachment 1 provides a summary of the habitat used by the northern Mexican gartersnake. The land cover types that this species can use as habitat are marsh (Marsh Types 1-7) and adjacent riparian habitat. Riparian habitat associated with marsh that was assessed to be impacted in the 2005 HCP is CW I-IV.

The buffer distance to define the riparian habitat for northern Mexican gartersnake is proposed at 600 feet from the edge of the marsh. This is based on the main area of activity observed in radio tracking studies and trapping studies which range from 50 feet to 528 feet from the water's edge (Emmons 2014; Nowak et al. 2011; Emmons and Nowak 2016; Rosen and Schwalbe 1988; USFWS 2013b). Activities included foraging, seeking mates, gestation, and terrestrial movements of various distances. Additionally, the current draft proposed critical habitat (USFWS 2013b) uses a 600-foot buffer.

It is recognized that the northern Mexican gartersnake may be found, though less frequently, in additional upland areas up to 1 mile from known water sources (Cogan pers. comm.). In these situations it is hypothesized that they are opportunistically moving between foraging habitat patches and using upland cover sites such as burrows, rock structure, etc. (Gloyd 1937; Rosen and Schwalbe 1988). However, the majority of activities that may result in incidental take and the areas where most of the northern Mexican gartersnake activity will be is within marshes and within 600 feet of open water aquatic habitat.

Analysis of Impacts and Level of Take

Since the covered activities are not changing with the addition of the northern Mexican gartersnake, the conservation plan as outlined in the HCP will not change. A portion of the habitat already planned to be created will be managed for the gartersnake. Attachment 2 shows the amount of northern Mexican gartersnake habitat that will be impacted by the covered activities for reaches of the river. Since the covered actions have not changed, the impacts to Marsh 1-7 are the same as already described in the HCP.

To calculate the impacts for the riparian buffer and to be sure that the impact analysis was consistent, the LCR vegetation layer, from the 1997 vegetation mapping from the original impact analysis, was used. A 600 foot buffer was generated around each marsh expected to be affected by covered activities in Reaches 3, 4, and 5. These buffers were then intersected with all cottonwood-willow vegetation polygons in the vegetation layers. Whole cottonwood-willow polygons were not included, just the resultant intersecting area between the 600 foot marsh buffers and the cottonwood-willow polygons.

Attachment 3 describes the effects of the flow-related covered activities, the non-flow-related covered activities, and the effects of LCR MSCP implementation on northern Mexican gartersnake habitat. For Reaches 1-7, 243 acres of marsh and 984 acres of adjacent cottonwood-willow habitat could be impacted by implementation of covered activities. As noted in Attachment 3 – Effects of Flow-Related Covered Activities, periodic loss of ephemeral marshes and adjacent cottonwood-willow habitat in Lake Mead (Reach 1) could result in a low level of take.

Conservation Measures

Attachment 4 outlines the conservation measures. To mitigate the effects of the covered activities, conservation measure NMGS1 states that 512 acres of marsh will be created to provide northern Mexican gartersnake habitat. This created habitat will also be habitat for the Yuma clapper rail (HCP conservation measure CLRA1). Of the 5,940 acres of LCR MSCP-created cottonwood-willow I-IV, 984 acres will be created and managed near marshes to provide northern Mexican gartersnake habitat. Marsh associated with backwaters that are disconnected from the LCR channel are of higher value to NMGS than connected backwaters on the LCR and are the preferred type to achieve LCR MSCP conservation goals for this species. Marsh associated with disconnected backwaters are managed to limit non-native predatory species, to the extent practicable. Conservation measure NMGS2 provides for implementation of measures to avoid or minimize take of the northern Mexican gartersnake as provided through LCR MSCP best management practices. These practices will be developed in coordination with the USFWS and may include measures addressing worker education programs, speed limits, seasonal restrictions, backfilling or covering trenches overnight, and effects of non-native species. The following avoidance and minimization measures (AMM) outlined in the HCP would also apply to the gartersnake: AMM1, AMM2, AMM4, AMM5, and AMM6. These measures are ongoing and will be implemented to benefit the northern Mexican gartersnake, except where

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implementation would negatively affect other covered species. Since the measures are beneficial to all of the covered species, there may be temporary negative impacts that rise to the level of take, but overall will benefit the northern Mexican gartersnake. In addition, monitoring and research measure MRM2 would also apply.

Including the northern Mexican gartersnake for coverage would not increase program costs since the amount of habitat being created for the HCP would not be increasing, and, under Section 10.3 of the Implementing Agreement, the USFWS must consider and give full credit for conservation measures under the HCP already being implemented that would benefit the northern Mexican gartersnake. Implementation of some of the avoidance and minimization measures may result in nominal, additional costs at conservation areas, but these costs would be included under existing program costs and reflected accordingly in the LCR MSCP annual Implementation Report, Work Plan and Budget. Additional information on the northern Mexican gartersnake status is included in Attachment 5.

Attachment 1
Additional Text Added to Table 3-9 Beginning on Page 3-22 of the HCP

Table 3-9. LCR MSCP Habitat Models for Selected Species

Covered Species	Assumed Distribution by River Reach							Summary Habitat Description	LCR MSCP Land Cover Types Assumed to Support Species Habitat
	1	2	3	4	5	6	7		
Selected Threatened and Endangered Species									
Northern Mexican gartersnake	X		X	X	X	X	X	Associated with: 1. Aquatic or riparian habitat that includes: <ul style="list-style-type: none">Perennial or spatially intermittent streams of low to moderate gradient that possess appropriate amounts of in-channel pools, off-channel pools, or backwater habitat, and that possess a preferred natural, unregulated flow regimeLentic wetlands such as livestock tanks, springs, and cienegas; andShoreline habitat with adequate organic and inorganic structural complexity to allow for thermoregulation, gestation, shelter, protection from predators, and foraging opportunities (e.g., boulders, rocks, organic debris such as downed trees or logs, debris jams, small mammal burrows, or leaf litter); and 2. Adequate terrestrial space, 600 ft lateral extent to either side of bankfull stage, adjacent to designated stream systems with sufficient structural characteristics to support life-history functions such as gestation, immigration, emigration, and brumation.	Marsh types 1-7 and adjacent cottonwood willow I-IV

Attachment 2

Additional Text Added to Table 4-5 Beginning on Page 4-32 of the HCP

Table 4-5. Summary of Estimated Extent of Covered Species Habitat Affected with Implementation of the Covered Activities, Including Reduction in Annual Flow of 0.860 Million Acre-Feet in Reach 3 and of 1.574 Million Acre-Feet in Reaches 4 and 5 (acres)

Covered Species	Impacts of Non-Federal Covered Activities on Species Habitat			Impacts of Federal Non-Flow-Related Covered Activities	Total Impacts on Species Habitat
	Removed (Non-Flow-Related)	Degraded (Flow-Related)	Total Impacts of Implementation on Species Habitat		
Northern Mexican gartersnake	50	1,081	1,131	96	1,227

Attachment 3
Additional Text Added on Page 4-81 of the HCP

4.5.28 Northern Mexican Gartersnake

The potential effects of implementing covered activities and LCR MSCP conservation measures on the rangewide distribution and status of the northern Mexican gartersnake are expected to be minor, affecting a relatively small number of individuals and proportion of its habitat throughout its range over the term of the LCR MSCP. The LCR MSCP Conservation plan includes conservation measures to avoid and minimize direct effects of implementing covered activities and the LCR MSCP on the northern Mexican gartersnake, and the potential effects of habitat loss expected to be minimized with the creation of replacement habitat.

4.5.28.1 Effects of Flow-Related Covered Activities

Flow-related activities may result in take of the northern Mexican gartersnake. Changes in points of diversion in Reaches 3-5 will lower groundwater levels sufficiently in these reaches to reduce the extent of 1,081 acres of habitat (see Table 4-5) provided by marshes associated with backwaters and adjacent cottonwood-willow. Reservoir elevations in Reaches 3-5 would not be affected by lower river stage elevations. Consequently, flow-related activities are not expected to affect habitat associated with marshes maintained by reservoirs (e.g., Bill Williams Delta - Reach 3) or that are managed to support marsh vegetation (e.g., Imperial NWR - Reach 5). Through implementation of AMM2, the LCR MSCP will avoid potential effects of lowering groundwater elevations on an additional 149 (16 acres of marsh and a maximum of 133 acres of cottonwood-willow) acres of habitat at Topock Marsh by maintaining water deliveries to Topock Marsh for maintenance of water levels and existing habitat conditions (see Table 4-3). Lowering groundwater elevations could cause direct loss of these habitats through desiccation, fragmentation, or reduction in the extent of habitat patches.

As described in Section 4.2.3.3 and Section 4.2.3.2, implementation of flow-related covered activities may affect marsh vegetation and adjacent cottonwood-willow that provides northern Mexican gartersnake habitat that periodically establish at inflow points of Lake Mead (e.g., Colorado River delta, Virgin River delta, Muddy River delta) when Lake Mead water surface elevations are below full pool. Marsh habitat below the full pool elevation will be created and lost based on water surface elevations. For example, marsh vegetation established at a certain elevation may be lost if the water surface elevation declines so that groundwater elevations drop below the rooting depths of emergent vegetation. Alternatively, established marsh vegetation would be inundated and lost during wetter periods, when Lake Mead reservoir elevations rise. The frequency, extent, and value of habitat and attendant species benefits that could be periodically

created and subsequently lost as a result of changes in reservoir elevations over the term of the LCR MSCP cannot be predicted based on the available information. The periodic loss of these ephemeral marshes, however, could result in a low level of take of the northern Mexican gartersnake over the term of the LCR MSCP.

As described in Section 4.2.2.3, effects of ongoing flow-related covered activities could contribute to a minimal and unquantifiable level of degradation of marshes that provide habitat over the term of the LCR MSCP.

4.5.28.2 Effects of Non-Flow-Related Covered Activities

Proposed activities related to habitat restoration and maintenance projects, facilities and infrastructure maintenance, may result in take of the northern Mexican gartersnake. The likelihood for take is expected to increase over the term of the LCR MSCP if the abundance of the northern Mexican gartersnake increases in the LCR MSCP planning area as a result of implementing LCR MSCP conservation measures for this species. Restoration-related activities that effect surface habitat, such as operation of equipment to remove vegetation, could result in temporary or permanent loss of habitat and harassment or mortality of individuals. These activities, however, would be conducted, to the extent practicable, when individuals are least likely to be active on the ground surface. Restoration-related activities that effect sub-surface habitat or potential cover sites (ground-disturbing projects with heavy equipment, etc.), would be conducted during the times of year when individuals are most likely to be surface active and can move out of harm's way. Effects on habitat would be temporary for restoration projects that restore or improve existing northern Mexican gartersnake habitat. The probability for permanent loss of habitat is considered minimal because restoration projects undertaken in existing northern Mexican gartersnake habitat will be designed to maintain or improve its habitat, and it is unlikely that state fish and wildlife agencies would remove northern Mexican gartersnake habitat to restore habitat for other species. However, because habitat restoration sites have not yet been identified, it is assumed that up to 10 acres of degraded or former marsh and up to 10 acres of degraded cottonwood-willow land cover that provides low-value habitat could be removed over the term of the LCR MSCP to restore habitat for other species (see Table 4-5).

Activities associated with maintaining facilities and infrastructure may result in the periodic removal of emergent vegetation growing in canals and drains that may provide northern Mexican gartersnake habitat. Up to 557 miles of canals and drains that could support some patches of emergent vegetation could be subject to periodic maintenance activities that would remove emergent vegetation over the term of the LCR MSCP. As described in Section 4.2.3.1, it is unlikely that maintenance of canals would measurably affect the extent of species habitat. Periodic maintenance of the 244 miles of drains in the LCR MSCP planning area, however, could result in the removal of up to 30 acres of

emergent vegetation that could provide habitat. Implementation of Federal non-flow-related covered activities addressed in the LCR MSCP BA could result in the loss of an additional 96 acres of species habitat (see Table 4-5).

As described in Section 4.2.2.3, implementation of ongoing non-flow-related covered activities are not expected to result in indirect effects on the northern Mexican gartersnake.

4.5.28.3 Effects of LCR MSCP Implementation

Activities associated with creating and maintaining habitat for covered species may result in take of the northern Mexican gartersnake. LCR MSCP habitat creation-related activities could result in temporary disturbance of habitat and harassment of individuals if they are present at the time activities are implemented, but these activities will avoid removal of primary habitat to establish habitat for other covered species. Up to 512 acres of existing degraded or former marsh that may provide low-value habitat could be converted to fully functioning marsh that provides high-value northern Mexican gartersnake habitat. Some additional limited and low-value (e.g., dry patches of herbaceous vegetation near marsh edges) could be converted to habitat to benefit other covered species; however, with implementation of the AMM's described in Section 5.6.1, "Avoidance and Minimization Measures", removal of these low-quality habitats is not expected to result in harm (i.e., injury or mortality of individuals) and, therefore, is not expected to result in take of the northern Mexican gartersnake.

Habitat management-related activities, such as operation of equipment to remove vegetation and maintain open water in backwaters, burning decadent marsh vegetation to stimulate vegetation growth, periodic removal of trees in patches of created habitat to encourage stand regeneration, and operation of equipment to maintain roads, could result in temporary loss of habitat and harassment, injury, or mortality of individuals. The maximum extent of habitat that could be affected by habitat management activities is estimated to be 1,496 acres (i.e., the extent of marsh and cottonwood-willow land cover to be created as habitat for associated covered species) over the term of the LCR MSCP. The likelihood for take is expected to increase over the term of the LCR MSCP if the abundance of the northern Mexican gartersnake increases in the LCR MSCP planning area as a result of implementing LCR MSCP conservation measures for this species. The level of adverse effects on habitats and individuals will depend on the type and extent of LCR MSCP habitat management activities that are undertaken in species habitat.

Attachment 4
Additional Text Added on Page 5-73 of the HCP

5.7.28 Northern Mexican Gartersnake

5.7.28.1 Summary of Effects

Implementation of covered activities and LCR MSCP conservation measures could result in the loss of up to 1,131 acres of northern Mexican gartersnake habitat and take of individuals. Implementation of Federal non-flow-related covered activities addressed in the amendment to the LCR MSCP BA could result in the loss of an additional 96 acres of habitat. Some additional limited and low value habitat (e.g., dry patches of herbaceous vegetation near marsh edges) could be affected by habitat creation and maintenance activities; however, the level of take is assumed to be low because of the limited value of the potentially affected habitat.

5.7.28.2 Conservation Measures

NMGS1—Create 1,496 acres of northern Mexican gartersnake habitat. Create and manage 512 acres of marsh to provide northern Mexican gartersnake habitat. This created habitat will also be habitat for the Yuma clapper rail (conservation measure CLRA1). Of the 5,940 acres of LCR MSCP created cottonwood-willow I-IV, 984 acres will be created and managed near to marshes to provide northern Mexican gartersnake habitat. Additional northern Mexican gartersnake habitat may be provided by marsh vegetation that becomes established along margins of the 360 acres of backwaters that will be created. These small patches of habitat may provide linkages between existing habitat and may facilitate the colonization of created habitats. Marsh associated with backwaters that are disconnected from the LCR channel are of higher value to northern Mexican gartersnake than connected backwaters on the LCR and are the preferred type to achieve LCR MSCP conservation goals for this species. Marsh associated with disconnected backwaters are managed to limit non-native predatory species, to the extent practicable. The design and management criteria described in the conservation measures for Yuma clapper rail (HCP Section 5.7.1), California black rail (HCP Section 5.7.13), southwestern willow flycatcher (HCP Section 5.7.2) and yellow-billed cuckoo (HCP Section 5.7.14) will ensure that created cottonwood-willow and marsh areas will also provide other habitat requirements for this species.

NMGS2—Implement conservation measures to avoid or minimize take of northern Mexican gartersnakes. Implement measures to avoid or minimize take of northern Mexican gartersnakes. These measures could include worker education programs and other practices in accordance with LCR MSCP best management practices.

5.7.28.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the LCR MSCP conservation measures, including creation of 1,496 acres of habitat, achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of covered activities and LCR MSCP implementation on the northern Mexican gartersnake, and to contribute to its recovery. Implementation of these measures will help ensure that the existing abundance of the species in the LCR MSCP planning area is maintained as a result of fully replacing affected habitat and maintaining existing habitat that otherwise could decline in function or be lost without management intervention. In addition, implementation of the conservation measures will benefit the northern Mexican gartersnake by increasing the amount of new habitat in the LCR MSCP planning area by 269 acres, in addition to replacing the extent of affected habitat.

Attachment 5
Additional Text Added on Page I-29 of Appendix I of the HCP

I.1.1.7 Northern Mexican Gartersnake (*Thamnophis eques megalops*)

Legal Status

The northern Mexican gartersnake is a subspecies of the Mexican gartersnake (*Thamnophis eques*); the only subspecies that occurs in the United States and is listed as a Threatened species under the ESA. The USFWS also proposed designation of critical habitat for this species in July, 2013 (USFWS 2013b). The USFWS has not yet published a final rule on critical habitat.

Other Status

- G4T3 (global rank) in NatureServe and 1A (state rank) in the Arizona Heritage Data Management System.
- A wildlife species of special concern in Arizona
- Not listed in the CNDDDB (there are apparently no records of this species from the California counties along the Colorado River)
- Not listed in the Nevada Natural Heritage Program. It is noted as a historic species.

Species Distribution

At the time the LCR MSCP was established in 2005, the northern Mexican gartersnake was considered extirpated from the area surrounding the mainstem of the LCR and had not been considered as a potential covered species. The species was re-documented in 2012 below Alamo Dam on the Bill Williams River and later in its largest tributaries. More recently, it was documented on the Havasu National Wildlife Refuge within Beal Lake Conservation Area in Mohave County, Arizona.

AGFD conducted surveys for the Colorado River toad (*Bufo alvarius*) and the lowland leopard frog (*Rana yavapaiensis*) in potential habitat within the LCR MSCP planning area from south of Davis Dam to the Southerly International Boundary and the Bill Williams River from east of Planet Ranch west to the confluence with Lake Havasu from 2011-2013 (Cotten 2011; Cotten and Grandmaison 2012). Lentic (of, relating of, or living in still waters such as lakes, ponds, or swamps) and lotic (of, relating to, or living in actively moving water) backwaters and desert washes that appeared to provide suitable

habitat for the toad and frog were surveyed using funnel trap arrays, visual encounter surveys, and nocturnal audio surveys (Cotten 2011; Cotten and Grandmaison 2012). During these surveys, ten northern Mexican gartersnakes were captured in funnel traps along the Bill Williams River upstream of Planet Ranch in 2012 (Cotten 2011; Cotten and Grandmaison 2012).

The northern Mexican gartersnake can be secretive and difficult to detect especially if present in low densities (Emmons and Nowak 2013; Cotten pers. comm.). The surveys from 2011-2013 were targeted for the frog and toad, not the northern Mexican gartersnake; methods, trap placement, location, and timing would be different depending upon the targeted species (Cotten pers. comm.).

Habitat Requirements and Species Considerations

Habitat

In Arizona, Rosen and Schwalbe (1988) found that the most important habitat characteristics for the northern Mexican gartersnake were permanent water, dense bankline vegetation, and an abundance of prey species. Surveys and observations of northern Mexican gartersnakes in Mexico suggested that dense vegetation is most important as protective cover where the gartersnake occurs with harmful nonnative species, but in largely or wholly native communities, vegetation density is much less important to survival (Burger 2007). Individuals often remain concealed under surface cover or subsurface in burrows and are found in areas with protected backwaters, braided side channels, beaver ponds, isolated pools near the main stem of the river, edges of dense emergent vegetation, dried up channels, ample downed and vegetative cover, and flooded areas (Emmons and Nowak 2013). Surveys in Mexico for the northern Mexican gartersnake found the species to be abundant in areas where habitat was severely degraded with no or low vegetation cover but had few or no harmful nonnative species present and maintained a suitable native prey base, suggesting that in the absence of harmful nonnative species, dense vegetation is less important in maintaining healthy gartersnake populations (Burger 2007; Servoss pers. comm.). While actively foraging, studies have shown that northern Mexican gartersnakes usually stay within 15 meters of a water source (a direct function of preferred prey) but will move farther away on occasion for gestation, periods of dormancy, ecdysis (shedding) cycles, etc. (Rosen and Schwalbe 1988). They have been observed from over 500 feet (Emmons 2014) to over one mile away (Cogan pers. comm.) from the water for sheltering purposes, foraging on land, and moving to other water sources or hibernation sites (Nowak et al. 2011; Rosen and Schwalbe 1988; USFWS 2013b).

Sheltering Habitat

Northern Mexican gartersnakes take shelter or cover in dense herbaceous vegetation, dense emergent vegetation, holes, root crevices, submergent vegetation, debris dams, downed logs or trees, rocky areas or rock piles, animal burrows, and man-made cover such as riprap or debris piles (Conant 2003; Emmons and Nowak 2013; Nowak et al. 2011; Rosen and Schwalbe 1988; Cotten pers. comm.). The presence of small diameter trees provides additional habitat complexity, thermoregulatory opportunities, and cover for the northern Mexican gartersnake (USFWS 2014).

Habitat Used During Prolonged Inactivity

The northern Mexican gartersnake will use areas of cover with optimal thermal requirements for cover during periods of prolonged inactivity (Cotten pers. comm.). Steep hills, river banks, upland burrows, and cliffs adjacent to riparian areas near permanent water sources can provide such areas for the species (Nowak et al. 2011). Individuals will also use small mammal burrows, packrat middens, debris piles, flood debris drifts, rock piles, and retaining wall rip-rap (Cotten pers. comm.).

Diet

Potential prey along the main stem of the LCR include the Woodhouse's toad (*Anaxyrus woodhousii*), Pacific tree frog (*Hyla regilla*), invertebrates, lizards, and small mammals (Cotten 2011; Cotten and Grandmaison 2012; Rorabaugh et al. 2004). Potential prey species found along the Bill Williams River are the Arizona toad (*Anaxyrus microschaphus*), red-spotted toad (*Anaxyrus punctatus*), longfin dace (*Agosia chrysogaster*), invertebrates, lizards, and small mammals (Cotten 2011; Cotten and Grandmaison 2012). Small size classes of harmful nonnative fish may also be used as prey including largemouth bass (*Micropterus* sp.), black bullheads (*Ameiurus melas*), and American bullfrogs (*Lithobates catesbeianus*) (Emmons and Nowak 2016b).

Breeding

Exact timing of breeding events vary with elevation (Rosen and Schwalbe 1988). Mating occurs in fall and spring, and females store the sperm until ovulation in late March or early April (Rosen and Schwalbe 1988). Northern Mexican gartersnake females give birth to live young from late May through early July (Brennan and Holycross 2006; Rosen and Schwalbe 1988; Wallace 2002). Manjarrez (1998) noticed that births were positively correlated with temperature.

Females can have up to 38 young during one breeding season (Nowak and Boyarski 2012) and the size of the litter is positively correlated with the length of the female (Manjarrez 1998; Rosen and Schwalbe 1988). Female northern Mexican gartersnakes have been found to bear young in warm microenvironments 5 to 15 meters from the water, using rock walls, the ground, and sun-warmed sacaton tussocks (Rosen and Schwalbe 1988), but may give birth in a variety of microhabitats and distances from water. The breeding season in this area is estimated to occur between March and July (March-May mating; May-August live birth).

Behavior

The northern Mexican gartersnake is considered a terrestrial and aquatic generalist (USFWS 2013b). The northern Mexican gartersnake is active during the warmer months of the year; they are the most active from May to September (Degenhardt et al. 1996; Emmons and Nowak 2013; Manjarrez 1998), but surface activity patterns may depend heavily on elevation and climate, with longer windows of activity at lower elevations. Northern Mexican gartersnakes will bask on any substrate, natural or artificial, including on reeds, stones, the ground, and rocks (Rosen 1991; Conant 2003).

The northern Mexican gartersnake forages along watercourses and seeks shelter in thick streamside vegetation (Degenhardt et al. 1996), burrows, under debris, rocks, etc. The northern Mexican gartersnake was observed demonstrating a wide variety of foraging methods including ambushing prey in water and on land, active foraging in riffles, vegetation mats, grass, and open water, and feeding in areas where there are temporary concentrations of prey (Rosen and Schwalbe 1988). The Mexican gartersnake, including the northern subspecies, primarily forages along the shoreline of the water source but occasionally dives in water, forages away from the shoreline, and forages on the pond's surface (Drummond and Garcia 1989). Mexican gartersnakes have been observed hanging from holes between the rocks with their head in the water and catching fish as they swam by and by floating in the water wiggling their tails to catch fish (Conant 2003 page 16).

The northern Mexican gartersnake can be difficult to detect due to their secretive nature, their ability to quickly escape underwater, and their ability to persist in low population densities (USFWS 2013b). Additionally, the northern Mexican gartersnake coexists with other species of gartersnakes across their distribution (Rosen and Schwalbe 1988; Tanner 1959).

Regionally Significant Populations in the LCR MSCP Planning Area

In the spring of 2015, the LCR MSCP was notified by Great Basin Bird Observatory that they may have sighted a northern Mexican gartersnake at Beal Lake Conservation Area on the Havasu National Wildlife Refuge in Arizona during riparian bird monitoring. The AGFD, USFWS, and U.S. Geological Survey (USGS) were notified and five photographs were provided for identification. A gartersnake was observed on May 4, 2015, in the same area and two additional photographs were taken for identification. The USFWS notified the LCR MSCP on June 1, 2015, that the species was confirmed as a northern Mexican gartersnake by Taylor Cotten and Tom Jones of AGFD and Jeff Servoss of the USFWS.

Northern Mexican gartersnake distribution and abundance within the Beal Lake Conservation Area is not well known at this time. From the photographs, it is likely

that the sightings described above were of the same individual. The snake may have come from Topock Marsh as it was found on a road about 275 meters from Topock Marsh to the north and well over 800 meters from open water of the backwater to the south. However, due to the cryptic nature of the species and ineffectiveness of species specific surveys, species presence and absence determinations can be unreliable. The LCR MSCP has reviewed the existing literature and coordinated with biologists knowledgeable of the species to predict the potential for encountering gartersnakes based on the habitat type and species preferences. It is also important to note that due to the mild winter temperatures in the area (rarely below freezing for long periods of time) and preliminary findings from telemetry research along the Verde River, the snakes may exhibit more surface activity than previously suspected and may be more active in the winter months compared to other locations.

Population Status and Reasons for Decline

The population is listed under the ESA as Threatened. Reductions in range and population densities have affected the status of the northern Mexican gartersnake significantly in the last 30 years. The subspecies occurs at low to very low population densities or may even be extirpated in as much as 90 percent of the northern Mexican gartersnake's historical distribution in the United States. As of 2016, there were only five northern Mexican gartersnake populations in the United States where the subspecies remains reliably detected and is considered viable, and all are located in Arizona. The five known populations are: (1) The Page Springs and Bubbling Ponds State Fish Hatcheries along Oak Creek; (2) lower Tonto Creek; (3) the upper Santa Cruz River in the San Rafael Valley; (4) the Bill Williams River; and (5) the upper and middle Verde River. As many as 23 of 33 known northern Mexican gartersnake localities in the United States (70 percent) are likely not viable and may exist at low population densities that could be threatened with extirpation or may already be extirpated. (Servoss pers. comm.)

Northern Mexican gartersnake populations have declined primarily from interactions with harmful nonnative species such as bullfrogs, crayfish, and predatory fish. These nonnative species prey upon, or compete with the gartersnakes and the native prey species that are vital to their existence. Human activities that diminish surface water or degrade streamside (riparian) vegetation are also significant threats, but particularly where they co-occur in the presence of nonnative species (USFWS 2014).

Current Threats to Species Survival

The presence of harmful nonnative species constitutes the most significant threat to the gartersnake. Harmful nonnative species directly prey upon the gartersnake and compete with them for prey. Landscape-level effects from the continued expansion of harmful

nonnative species have changed the spatial orientation of the gartersnakes' distribution, creating greater isolation between populations. The prey base of these gartersnakes includes native amphibians and fish populations. Declines in their prey base have led to subsequent declines in the distribution and density of gartersnake populations. In most areas across their range, prey base declines are largely attributed to the introduction and expansion of harmful nonnative species (USFWS 2014).

Human activities that diminish surface water or degrade streamside (riparian) vegetation urbanization and road construction and use are also significant threats, but particularly where they co-occur in the presence of nonnative species (USFWS 2014).

Management Needs

The creation or restoration of marshes for Yuma clapper rail and creation of cottonwood-willow habitat for southwestern willow flycatcher will benefit the northern Mexican gartersnake. Marsh associated with backwaters that are disconnected from the LCR channel are of higher value to northern Mexican gartersnake than connected backwaters on the LCR and are the preferred type to achieve LCR MSCP conservation goals for this species. Marsh associated with disconnected backwaters are managed to limit non-native predatory species, to the extent practicable.

Existing Management Actions

No existing management actions have been identified for the northern Mexican gartersnake. The AGFD's conservation and mitigation program (CAMP; implemented under an existing section 7 incidental take permit) has committed to either stocking (with captive-bred stock) or securing two populations each of northern Mexican and narrow-headed gartersnakes to help minimize adverse effects to these species from their sport fish stocking program through 2021 (USFWS 2011, Appendix C). Other CAMP commitments include: (1) Developing a gartersnake monitoring, research, and restocking plan to guide CAMP activities to establish or secure populations; (2) developing outreach material to reduce the deliberate killing or injuring of gartersnakes (placed in high angler access areas); (3) ensuring that chemically renovated streams are quickly restocked with native fish as gartersnake prey; (4) conducting a live bait assessment team to develop recommendations to amend live bait management; (5) reviewing and updating outreach programs on the risks to native aquatic species from the transport of nonnative aquatic species; (6) developing and implementing a public education program on gartersnakes; and (7) working with the New Mexico Department of Game and Fish to examine the roll of escaped rainbow trout from Luna Lake into tributaries to the San Francisco River in supporting narrow-headed gartersnakes.

Recovery Goals

The recovery plan for the northern Mexican gartersnake has not yet been prepared; there are no agency-mandated recovery goals for the northern Mexican gartersnake at this time.

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Appendix X – Biological Assessment Amendment

Addition of New Covered Species – Northern Mexican Gartersnake

Final Appendices to Volumes I-III and V

Volume IV

Background and Appendix Format

The northern Mexican gartersnake (*Thamnophis eques megalops*) was not considered for coverage during the 2005 development of the LCR MSCP Biological Assessment (BA), because it was believed to be extirpated within the planning area. However based on a number of events, as described below, the LCR MSCP is now seeking to add the northern Mexican gartersnake to the list of covered species under the program.

- On July 10, 2013, the U. S. Fish and Wildlife Service (USFWS) published in the *Federal Register* a proposed rule to list the northern Mexican gartersnake as Threatened under the Endangered Species Act and a proposed rule for critical habitat designation (USFWS 2013a; USFWS 2013b). The final rule listing the northern Mexican gartersnake as Threatened under the Endangered Species Act was published on July 8, 2014 (USFWS 2014). Habitat identified for critical habitat was proposed on the Bill Williams River in Arizona (the proposed Bill Williams River Unit) within the LCR MSCP implementation area between Alamo Dam and the confluence of the Colorado River and Bill Williams River.
- In 2012, personnel of the Arizona Game and Fish Department (AGFD) discovered northern Mexican gartersnakes on the Bill Williams River in Arizona between Planet Ranch and Alamo Dam while conducting amphibian surveys. This portion of the Bill Williams River is within the LCR MSCP implementation area (Reach 3). In December 2015, the Planet Ranch Conservation Area was included in the program. The conservation area includes existing agricultural fields, the active floodplain of the Bill Williams River where flows are normally subsurface, and a portion of the Bill Williams River adjacent to the Bill Williams River National Wildlife Refuge where perennial surface water occurs. LCR MSCP habitat creation at Planet Ranch may result in creation of habitat that could be colonized by lowland leopard frogs and Colorado River toads, and now, northern Mexican gartersnakes.
- In 2015, a northern Mexican gartersnake was confirmed at the LCR MSCP's Beal Lake Conservation Area in the riparian field next to Willow Marsh on Havasu National Wildlife Refuge near Needles, California in LCR Reach 3. The Bureau of Reclamation (Reclamation) initiated a consultation with the USFWS for maintenance and infrastructure improvements at the Beal Lake Conservation Area and received a Biological Opinion in November 2015.

- In addition to being listed as threatened under the federal Endangered Species Act, the northern Mexican gartersnake is also designated as an Arizona Species of Greatest Conservation Need. There is no special regulatory designation for the species in California or Nevada. It is considered extirpated in California.

Information about the northern Mexican gartersnake contained in the attachments to this appendix are formatted for the BA. For example, Attachment 1 provides additional text appended to the end of Table 4-9 from the BA. The format for the new information presented herein is an extension of the original BA text.

Species Habitat Model

Covered species habitats had not been directly field delineated in the LCR MSCP planning area. Rather, species habitats were defined in the BA by application of species habitat models based on the likelihood for each land cover type to support species habitat. For these species, the analysis of the extent of their habitat began with a definition of the land cover types used for the species models. The land cover type classification system used in the LCR MSCP was derived from previous classifications developed by Anderson and Ohmart (1976, 1984) and Younker and Anderson (1986). For riparian species, land cover types were classified by plant community and structural type. For marsh species, land cover types were classified by plant community and characteristics.

Attachment 1 provides a summary of the habitat used by the northern Mexican gartersnake. The land cover types that this species can use as habitat are marsh (Marsh Types 1-7) and adjacent riparian habitat. Riparian habitat associated with marsh that was assessed to be impacted in the 2005 BA is CW I-IV.

The buffer distance to define the riparian habitat for northern Mexican gartersnake is proposed at 600 feet from the edge of the marsh. This is based on the main area of activity observed in radio tracking studies and trapping studies which range from 50 feet to 528 feet from the water's edge (Emmons 2014; Nowak et al. 2011; Emmons and Nowak 2016; Rosen and Schwalbe 1988; USFWS 2013b). Activities included foraging, seeking mates, gestation, and terrestrial movements of various distances. Additionally, the current draft proposed critical habitat (USFWS 2013b) uses a 600-foot buffer.

It is recognized that the northern Mexican gartersnake may be found, though less frequently, in additional upland areas up to 1 mile from known water sources (Cogan pers. comm.). In these situations it is hypothesized that they are opportunistically moving between foraging habitat patches and using upland cover sites such as burrows, rock structure, etc. (Gloyd 1937; Rosen and Schwalbe 1988). However, the majority of activities that may result in incidental take and the areas where most of the northern Mexican gartersnake activity will be is within marshes and within 600 feet of open water aquatic habitat.

Analysis of Impacts and Level of Take

Since the covered activities are not changing with the addition of the northern Mexican gartersnake, the conservation plan as outlined in the HCP will not change. A portion of the habitat already planned to be created will be managed for the gartersnake. Attachment 2 shows the amount of northern Mexican gartersnake habitat that will be impacted by the covered activities for reaches of the river. Since the covered actions have not changed, the impacts to Marsh 1-7 are the same as already described in the BA.

To calculate the impacts for the riparian buffer and to be sure that the impact analysis was consistent, the LCR vegetation layer, from the 1997 vegetation mapping from the original impact analysis, was used. A 600 foot buffer was generated around each marsh expected to be affected by covered activities in Reaches 3, 4, and 5. These buffers were then intersected with all cottonwood-willow vegetation polygons in the vegetation layers. Whole cottonwood-willow polygons were not included, just the resultant intersecting area between the 600 foot marsh buffers and the cottonwood-willow polygons.

Attachment 3 describes the effects of the flow-related covered activities, the Federal non-flow-related covered activities, the effects of LCR MSCP implementation, and the effects on proposed critical habitat. Attachment 4 describes the effects of the non-federal non-flow-related covered activities. For Reaches 1-7, 243 acres of marsh and 984 acres of adjacent cottonwood-willow habitat could be impacted by implementation of covered activities. As noted in Attachment 3 – Effects of Flow-Related Covered Activities, periodic loss of ephemeral marshes and adjacent cottonwood-willow habitat in Lake Mead (Reach 1) could result in a low level of take.

Cumulative effects are defined under ESA regulations as those effects of future state or private activities, not involving Federal activities that are reasonably certain to occur within the action area of the Federal action subject to consultation. Since some new specific projects have been identified in the Planning Area since the completion of the BA, the potential for new cumulative impacts was also considered. The cumulative impact analysis in the BA considered both specific projects and general categories of projects, therefore evaluating a wide range of potential impacts from construction, agricultural, restoration, and flow related activities. Although there are new site specific projects within the planning area, their impacts would be within the range of potential impacts evaluated in the BA and therefore, there would not be any additional cumulative effects or changes to the summary of effects analysis (BA Chapter 7).

Attachment 5 summarizes the potential effects of implementing the Federal and non-Federal covered activities and the LCR MSCP Conservation Plan on the northern Mexican gartersnake.

Additional information on the northern Mexican gartersnake status is included in Attachment 6.

Attachment 1
Additional Text Added to Table 4-9 After Page 4-22 of the BA

Table 4-9. LCR MSCP Habitat Models for Selected Species

Covered Species	Assumed Distribution by River Reach							Summary Habitat Description	LCR MSCP Land Cover Types Assumed to Support Species Habitat
	1	2	3	4	5	6	7		
Selected Threatened and Endangered Species									
Northern Mexican gartersnake	X		X	X	X	X	X	Associated with: 1. Aquatic or riparian habitat that includes: <ul style="list-style-type: none">Perennial or spatially intermittent streams of low to moderate gradient that possess appropriate amounts of in-channel pools, off-channel pools, or backwater habitat, and that possess a preferred natural, unregulated flow regimeLentic wetlands such as livestock tanks, springs, and cienegas; andShoreline habitat with adequate organic and inorganic structural complexity to allow for thermoregulation, gestation, shelter, protection from predators, and foraging opportunities (e.g., boulders, rocks, organic debris such as downed trees or logs, debris jams, small mammal burrows, or leaf litter); and 2. Adequate terrestrial space, 600 ft lateral extent to either side of bankfull stage, adjacent to designated stream systems with sufficient structural characteristics to support life-history functions such as gestation, immigration, emigration, and brumation.	Marsh types 1-7 and adjacent cottonwood willow I-IV

Attachment 2

Additional Text Added to Table 5-5 After Page 5-34 of the BA

Table 5-5 Summary of Estimated Extent of Covered Species Habitat Affected with Implementation of the Covered Activities, Including Reduction in Annual Flow of 0.860 Million Acre-Feet in Reach 3 and of 1.574 Million Acre-Feet in Reaches 4 and 5 (acres)

Covered Species	Impact on Species Habitat			Total
	Degraded (Flow-Related)	Federal Non-Flow- Related Activities	State Non- Flow-Related Activities	
Northern Mexican gartersnake	1,081	96	50	1,227

Attachment 3
Additional Text Added on Page 5-95 of the BA

5.5.28 Northern Mexican Gartersnake

The potential effects of implementing covered activities and LCR MSCP conservation measures on the rangewide distribution and status of the northern Mexican gartersnake are expected to be minor, affecting a relatively small number of individuals and proportion of its habitat throughout its range over the term of the LCR MSCP. The LCR MSCP Conservation plan includes conservation measures to avoid and minimize direct effects of implementing covered activities and the LCR MSCP on the northern Mexican gartersnake, and the potential effects of habitat loss expected to be minimized with the creation of replacement habitat. For the reasons described below, implementation of the flow-related and non-flow related covered activities and the LCR MSCP is likely to adversely affect the northern Mexican gartersnake.

5.5.28.1 Effects of Flow-Related Covered Activities

Flow-related activities may result in take of the northern Mexican gartersnake. Changes in points of diversion in Reaches 3-5 will lower groundwater levels sufficiently in these reaches to reduce the extent of 1,081 acres of habitat (see Table 5-5) provided by marshes associated with backwaters and adjacent cottonwood-willow. Reservoir elevations in Reaches 3-5 would not be affected by lower river stage elevations. Consequently, flow-related activities are not expected to affect habitat associated with marshes maintained by reservoirs (e.g., Bill Williams Delta - Reach 3) or that are managed to support marsh vegetation (e.g., Imperial NWR (Reach - 5)). Through implementation of AMM2, the LCR MSCP will avoid potential effects of lowering groundwater elevations on an additional 149 (16 acres of marsh and a maximum of 133 acres of cottonwood willow) acres of habitat at Topock Marsh by maintaining water deliveries to Topock Marsh for maintenance of water levels and existing habitat conditions (see Table 5-3). Lowering groundwater elevations could cause direct loss of these habitats through desiccation, fragmentation, or reduction in the extent of habitat patches.

As described in Section 5.2.3.3 and Section 5.2.3.2, implementation of flow-related covered activities may affect marsh vegetation and adjacent cottonwood-willow that provides northern Mexican gartersnake habitat that periodically establish at inflow points of Lake Mead (e.g., Colorado River delta, Virgin River delta, Muddy River delta) when Lake Mead water surface elevations are below full pool. Marsh habitat below the full pool elevation will be created and lost

based on water surface elevations. For example, marsh vegetation established at a certain elevation may be lost if the water surface elevation declines so that groundwater elevations drop below the rooting depths of emergent vegetation. Alternatively, established marsh vegetation would be inundated and lost during wetter periods, when Lake Mead reservoir elevations rise. The frequency, extent, and value of habitat and attendant species benefits that could be periodically created and subsequently lost as a result of changes in reservoir elevations over the term of the LCR MSCP cannot be predicted based on the available information. The periodic loss of these ephemeral marshes, however, could result in a low level of take of the northern Mexican gartersnake over the term of the LCR MSCP.

As described in Section 5.2.2.3, effects of ongoing flow-related covered activities could contribute to a minimal and unquantifiable level of degradation of marshes that provide habitat over the term of the LCR MSCP.

5.5.28.2 Effects of Federal Non-Flow-Related Covered Activities

Operation of equipment to implement non-flow-related covered activities (e.g., implementation of channel, desilting basin, boat ramp, gage station, and other facility maintenance activities; implementation of marsh and riparian restoration and maintenance projects; conversion of lands to agriculture) may result in injuries or fatalities of northern Mexican gartersnake. Effects may include displacement or decreased reproductive success. These activities are expected to result in some low level of take over the term of the LCR MSCP.

Up to 96 acres of northern Mexican gartersnake habitat could be removed to maintain channel functions (e.g. dredging desilting basins) (see Table 5-5). Activities associated with removal of habitat during the breeding season could result in fatalities of adults or young. These activities are expected to result in some low level of take over the term of the LCR MSCP. As described in Section 5.2.2.3, indirect effects of ongoing non-flow-related covered activities could contribute to a minimal and unquantifiable level of degradation of marshes that provide habitat over the term of the LCR MSCP.

The creation of northern Mexican gartersnake habitat through implementation of the LCR MSCP Conservation Plan is expected to result in an increase in the numbers and distribution of northern Mexican gartersnake in the LCR MSCP planning area. Consequently, the number of northern Mexican gartersnake exposed to disturbances caused by these types of non-flow-related activities is expected to increase in future years.

5.5.28.3 Effects of LCR MSCP Implementation

Activities associated with creating and maintaining habitat for covered species may result in take of the northern Mexican gartersnake. LCR MSCP habitat creation-related activities could result in temporary disturbance of habitat and harassment of individuals if they are present at the time activities are implemented, but these activities will avoid removal of primary habitat to establish habitat for other covered species. Up to 512 acres of existing degraded or former marsh that may provide low-value habitat could be converted to fully functioning marsh that provides high-value northern Mexican gartersnake habitat. Some additional limited and low-value (e.g., dry patches of herbaceous vegetation near marsh edges) could be converted to habitat to benefit other covered species; however, with implementation of the avoidance and minimization measures described in the LCR MSCP Conservation Plan, removal of these low-quality habitats is not expected to result in harm (i.e., injury or mortality of individuals) and, therefore, is not expected to result in take of the northern Mexican gartersnake.

Habitat management-related activities, such as operation of equipment to remove vegetation and maintain open water in backwaters, burning decadent marsh vegetation to stimulate vegetation growth, periodic removal of trees in patches of created habitat to encourage stand regeneration, and operation of equipment to maintain roads, could result in temporary loss of habitat and harassment, injury, or mortality of individuals. The maximum extent of habitat that could be affected by habitat management activities is estimated to be 1,496 acres (i.e., the extent of marsh and cottonwood-willow land cover to be created as habitat for associated covered species) over the term of the LCR MSCP. The likelihood for take is expected to increase over the term of the LCR MSCP if the abundance of the northern Mexican gartersnake increases in the LCR MSCP planning area as a result of implementing LCR MSCP conservation measures for this species. The level of adverse effects on habitats and individuals will depend on the type and extent of LCR MSCP habitat management activities that are undertaken in species habitat.

5.5.28.4 Effects on Proposed Critical Habitat

On July 10, 2013, the USFWS published in the *Federal Register* a proposed rule for critical habitat designation (USFWS 2013b) for the northern Mexican gartersnake. Habitat identified for critical habitat was proposed on the Bill Williams River in Arizona (the proposed Bill Williams River Unit) within the

LCR MSCP implementation area between Alamo Dam and the confluence of the Colorado River and Bill Williams River. The covered actions will have no effect on this proposed critical habitat as they occur outside the boundaries.

The following Sections in the BA have been renumbered as follows

5.5.28 to 5.5.29 Effects on Evaluation Species

5.5.28.1 to 5.5.29.1	California Leaf-Nosed Bat
5.5.28.2 to 5.5.29.2	Pale Townsend’s Big-Eared Bat
5.5.28.3 to 5.5.29.3	Colorado River Toad
5.5.28.4 to 5.5.29.4	Lowland Leopard Frog

5.6 Effects of Non-Federal Non-Flow Related Covered Activities

5.6.28 Northern Mexican Gartersnake

Proposed activities related to habitat restoration and maintenance projects, facilities and infrastructure maintenance, may result in take of the northern Mexican gartersnake. The likelihood for take is expected to increase over the term of the LCR MSCP if the abundance of the northern Mexican gartersnake increases in the LCR MSCP planning area as a result of implementing LCR MSCP conservation measures for this species. Restoration-related activities that effect surface habitat, such as operation of equipment to remove vegetation, could result in temporary or permanent loss of habitat and harassment or mortality of individuals. These activities, however, would be conducted, to the extent practicable, when individuals are least likely to be active on the ground surface. Restoration-related activities that effect sub-surface habitat or potential cover sites (ground-disturbing projects with heavy equipment, etc.), would be conducted during the times of year when individuals are most likely to be surface active and can move out of harm's way. Effects on habitat would be temporary for restoration projects that restore or improve existing northern Mexican gartersnake habitat. The probability for permanent loss of habitat is considered minimal because restoration projects undertaken in existing northern Mexican gartersnake habitat will be designed to maintain or improve its habitat, and it is unlikely that state fish and wildlife agencies would remove northern Mexican gartersnake habitat to restore habitat for other species. However, because habitat restoration sites have not yet been identified, it is assumed that up to 10 acres of degraded or former marsh and up to 10 acres of degraded cottonwood-willow land cover that provides low-value habitat could be removed over the term of the LCR MSCP to restore habitat for other species (see Table 4-5).

Activities associated with maintaining facilities and infrastructure may result in the periodic removal of emergent vegetation growing in canals and drains that may provide northern Mexican gartersnake habitat. Up to 557 miles of canals and drains that could support some patches of emergent vegetation could be subject to periodic maintenance activities that would remove emergent vegetation over the term of the LCR MSCP. As described in Section 5.2.3.1, it is unlikely that maintenance of canals would measurably affect the extent of species habitat. Periodic maintenance of the 244 miles of drains in the LCR MSCP planning area, however, could result in the removal of up to 30 acres of emergent vegetation that could provide habitat.

Implementation of non-Federal ongoing non-flow-related covered activities are not expected to result in indirect effects on the northern Mexican gartersnake.

The following Sections in the BA have been renumbered as follows

5.6.28 to 5.6.29 Effects on Evaluation Species

5.6.28.1 to 5.6.29.1	California Leaf-Nosed Bat
5.6.28.2 to 5.6.29.2	Pale Townsend's Big-Eared Bat
5.6.28.3 to 5.6.29.3	Colorado River Toad
5.6.28.4 to 5.6.29.4	Lowland Leopard Frog

Attachment 5
Additional Text Added to Table 7-1 After Page 7-1 of the BA

Table 7-1. Summary of Effects Analysis

Common and scientific name	Federal Status	No Effect	Effects Analysis			
			May Affect		Will Not Modify Critical Habitat	May Modify Designated Critical Habitat
			Not Likely to Adversely Affect	Likely to Adversely Affect		
Federal Threatened and Endangered Species						
Northern Mexican gartersnake <i>Thamnophis eques megalops</i>	FT			X		

Attachment 6
Additional Text Added on Page I-29 of Appendix I of the HCP

I.1.1.7 Northern Mexican Gartersnake (*Thamnophis eques megalops*)

Legal Status

The northern Mexican gartersnake is a subspecies of the Mexican gartersnake (*Thamnophis eques*); the only subspecies that occurs in the United States and is listed as a Threatened species under the ESA. The USFWS also proposed designation of critical habitat for this species in July, 2013 (USFWS 2013b). The USFWS has not yet published a final rule on critical habitat.

Other Status

- G4T3 (global rank) in NatureServe and 1A (state rank) in the Arizona Heritage Data Management System.
- A wildlife species of special concern in Arizona
- Not listed in the CNDDDB (there are apparently no records of this species from the California counties along the Colorado River)
- Not listed in the Nevada Natural Heritage Program. It is noted as a historic species.

Species Distribution

At the time the LCR MSCP was established in 2005, the northern Mexican gartersnake was considered extirpated from the area surrounding the mainstem of the LCR and had not been considered as a potential covered species. The species was re-documented in 2012 below Alamo Dam on the Bill Williams River and later in its largest tributaries. More recently, it was documented on the Havasu National Wildlife Refuge within Beal Lake Conservation Area in Mohave County, Arizona.

AGFD conducted surveys for the Colorado River toad (*Bufo alvarius*) and the lowland leopard frog (*Rana yavapaiensis*) in potential habitat within the LCR MSCP planning area from south of Davis Dam to the Southerly International Boundary and the Bill Williams River from east of Planet Ranch west to the confluence with Lake Havasu from 2011-2013 (Cotten 2011; Cotten and Grandmaison 2012). Lentic (of, relating of, or living in still waters such as lakes, ponds, or swamps) and lotic (of, relating to, or living in actively moving water) backwaters and desert washes that appeared to provide suitable

habitat for the toad and frog were surveyed using funnel trap arrays, visual encounter surveys, and nocturnal audio surveys (Cotten 2011; Cotten and Grandmaison 2012). During these surveys, ten northern Mexican gartersnakes were captured in funnel traps along the Bill Williams River upstream of Planet Ranch in 2012 (Cotten 2011; Cotten and Grandmaison 2012).

The northern Mexican gartersnake can be secretive and difficult to detect especially if present in low densities (Emmons and Nowak 2013; Cotten pers. comm.). The surveys from 2011-2013 were targeted for the frog and toad, not the northern Mexican gartersnake; methods, trap placement, location, and timing would be different depending upon the targeted species (Cotten pers. comm.).

Habitat Requirements and Species Considerations

Habitat

In Arizona, Rosen and Schwalbe (1988) found that the most important habitat characteristics for the northern Mexican gartersnake were permanent water, dense bankline vegetation, and an abundance of prey species. Surveys and observations of northern Mexican gartersnakes in Mexico suggested that dense vegetation is most important as protective cover where the gartersnake occurs with harmful nonnative species, but in largely or wholly native communities, vegetation density is much less important to survival (Burger 2007). Individuals often remain concealed under surface cover or subsurface in burrows and are found in areas with protected backwaters, braided side channels, beaver ponds, isolated pools near the main stem of the river, edges of dense emergent vegetation, dried up channels, ample downed and vegetative cover, and flooded areas (Emmons and Nowak 2013). Surveys in Mexico for the northern Mexican gartersnake found the species to be abundant in areas where habitat was severely degraded with no or low vegetation cover but had few or no harmful nonnative species present and maintained a suitable native prey base, suggesting that in the absence of harmful nonnative species, dense vegetation is less important in maintaining healthy gartersnake populations (Burger 2007; Servoss pers. comm.). While actively foraging, studies have shown that northern Mexican gartersnakes usually stay within 15 meters of a water source (a direct function of preferred prey) but will move farther away on occasion for gestation, periods of dormancy, ecdysis (shedding) cycles, etc. (Rosen and Schwalbe 1988). They have been observed from over 500 feet (Emmons 2014) to over one mile away (Cogan pers. comm.) from the water for sheltering purposes, foraging on land, and moving to other water sources or hibernation sites (Nowak et al. 2011; Rosen and Schwalbe 1988; USFWS 2013b).

Sheltering Habitat

Northern Mexican gartersnakes take shelter or cover in dense herbaceous vegetation, dense emergent vegetation, holes, root crevices, submergent vegetation, debris dams,

downed logs or trees, rocky areas or rock piles, animal burrows, and man-made cover such as riprap or debris piles (Conant 2003; Emmons and Nowak 2013; Nowak et al. 2011; Rosen and Schwalbe 1988; Cotten pers. comm.). The presence of small diameter trees provides additional habitat complexity, thermoregulatory opportunities, and cover for the northern Mexican gartersnake (USFWS 2014).

Habitat Used During Prolonged Inactivity

The northern Mexican gartersnake will use areas of cover with optimal thermal requirements for cover during periods of prolonged inactivity (Cotten pers. comm.). Steep hills, river banks, upland burrows, and cliffs adjacent to riparian areas near permanent water sources can provide such areas for the species (Nowak et al. 2011). Individuals will also use small mammal burrows, packrat middens, debris piles, flood debris drifts, rock piles, and retaining wall rip-rap (Cotten pers. comm.).

Diet

Potential prey along the main stem of the LCR include the Woodhouse's toad (*Anaxyrus woodhousii*), Pacific tree frog (*Hyla regilla*), invertebrates, lizards, and small mammals (Cotten 2011; Cotten and Grandmaison 2012; Rorabaugh et al. 2004). Potential prey species found along the Bill Williams River are the Arizona toad (*Anaxyrus microschaphus*), red-spotted toad (*Anaxyrus punctatus*), longfin dace (*Agosia chrysogaster*), invertebrates, lizards, and small mammals (Cotten 2011; Cotten and Grandmaison 2012). Small size classes of harmful nonnative fish may also be used as prey including largemouth bass (*Micropterus* sp.), black bullheads (*Ameiurus melas*), and American bullfrogs (*Lithobates catesbeianus*) (Emmons and Nowak 2016b).

Breeding

Exact timing of breeding events vary with elevation (Rosen and Schwalbe 1988). Mating occurs in fall and spring, and females store the sperm until ovulation in late March or early April (Rosen and Schwalbe 1988). Northern Mexican gartersnake females give birth to live young from late May through early July (Brennan and Holycross 2006; Rosen and Schwalbe 1988; Wallace 2002). Manjarrez (1998) noticed that births were positively correlated with temperature.

Females can have up to 38 young during one breeding season (Nowak and Boyarski 2012) and the size of the litter is positively correlated with the length of the female (Manjarrez 1998; Rosen and Schwalbe 1988). Female northern Mexican gartersnakes have been found to bear young in warm microenvironments 5 to 15 meters from the water, using rock walls, the ground, and sun-warmed sacaton tussocks (Rosen and Schwalbe 1988), but may give birth in a variety of microhabitats and distances from water. The breeding season in this area is estimated to occur between March and July (March-May mating; May-August live birth).

Behavior

The northern Mexican gartersnake is considered a terrestrial and aquatic generalist (USFWS 2013b). The northern Mexican gartersnake is active during the warmer months of the year; they are the most active from May to September (Degenhardt et al. 1996; Emmons and Nowak 2013; Manjarrez 1998), but surface activity patterns may depend heavily on elevation and climate, with longer windows of activity at lower elevations. Northern Mexican gartersnakes will bask on any substrate, natural or artificial, including on reeds, stones, the ground, and rocks (Rosen 1991; Conant 2003).

The northern Mexican gartersnake forages along watercourses and seeks shelter in thick streamside vegetation (Degenhardt et al. 1996), burrows, under debris, rocks, etc. The northern Mexican gartersnake was observed demonstrating a wide variety of foraging methods including ambushing prey in water and on land, active foraging in riffles, vegetation mats, grass, and open water, and feeding in areas where there are temporary concentrations of prey (Rosen and Schwalbe 1988). The Mexican gartersnake, including the northern subspecies, primarily forages along the shoreline of the water source but occasionally dives in water, forages away from the shoreline, and forages on the pond's surface (Drummond and Garcia 1989). Mexican gartersnakes have been observed hanging from holes between the rocks with their head in the water and catching fish as they swam by and by floating in the water wiggling their tails to catch fish (Conant 2003 page 16).

The northern Mexican gartersnake can be difficult to detect due to their secretive nature, their ability to quickly escape underwater, and their ability to persist in low population densities (USFWS 2013b). Additionally, the northern Mexican gartersnake coexists with other species of gartersnakes across their distribution (Rosen and Schwalbe 1988; Tanner 1959).

Regionally Significant Populations in the LCR MSCP Planning Area

In the spring of 2015, the LCR MSCP was notified by Great Basin Bird Observatory that they may have sighted a northern Mexican gartersnake at Beal Lake Conservation Area on the Havasu National Wildlife Refuge in Arizona during riparian bird monitoring. The AGFD, USFWS, and U.S. Geological Survey (USGS) were notified and five photographs were provided for identification. A gartersnake was observed on May 4, 2015, in the same area and two additional photographs were taken for identification. The USFWS notified the LCR MSCP on June 1, 2015, that the species was confirmed as a northern Mexican gartersnake by Taylor Cotten and Tom Jones of AGFD and Jeff Servoss of the USFWS.

Northern Mexican gartersnake distribution and abundance within the Beal Lake Conservation Area is not well known at this time. From the photographs, it is likely that the sightings described above were of the same individual. The snake may have come from Topock Marsh as it was found on a road about 275 meters from Topock Marsh to the north and well over 800 meters from open water of the backwater to the south. However, due to the cryptic nature of the species and ineffectiveness of species specific surveys, species presence and absence determinations can be unreliable. The LCR MSCP has reviewed the existing literature and coordinated with biologists knowledgeable of the species to predict the potential for encountering gartersnakes based on the habitat type and species preferences. It is also important to note that due to the mild winter temperatures in the area (rarely below freezing for long periods of time) and preliminary findings from telemetry research along the Verde River, the snakes may exhibit more surface activity than previously suspected and may be more active in the winter months compared to other locations.

Population Status and Reasons for Decline

The population is listed under the ESA as Threatened. Reductions in range and population densities have affected the status of the northern Mexican gartersnake significantly in the last 30 years. The subspecies occurs at low to very low population densities or may even be extirpated in as much as 90 percent of the northern Mexican gartersnake's historical distribution in the United States. As of 2016, there were only five northern Mexican gartersnake populations in the United States where the subspecies remains reliably detected and is considered viable, and all are located in Arizona. The five known populations are: (1) The Page Springs and Bubbling Ponds State Fish Hatcheries along Oak Creek; (2) lower Tonto Creek; (3) the upper Santa Cruz River in the San Rafael Valley; (4) the Bill Williams River; and (5) the upper and middle Verde River. As many as 23 of 33 known northern Mexican gartersnake localities in the United States (70 percent) are likely not viable and may exist at low population densities that could be threatened with extirpation or may already be extirpated. (Servoss pers. comm.)

Northern Mexican gartersnake populations have declined primarily from interactions with harmful nonnative species such as bullfrogs, crayfish, and predatory fish. These nonnative species prey upon, or compete with the gartersnakes and the native prey species that are vital to their existence. Human activities that diminish surface water or degrade streamside (riparian) vegetation are also significant threats, but particularly where they co-occur in the presence of nonnative species (USFWS 2014).

Current Threats to Species Survival

The presence of harmful nonnative species constitutes the most significant threat to the gartersnake. Harmful nonnative species directly prey upon the gartersnake and compete with them for prey. Landscape-level effects from the continued expansion of harmful nonnative species have changed the spatial orientation of the gartersnakes' distribution, creating greater isolation between populations. The prey base of these gartersnakes includes native amphibians and fish populations. Declines in their prey base have led to subsequent declines in the distribution and density of gartersnake populations. In most areas across their range, prey base declines are largely attributed to the introduction and expansion of harmful nonnative species (USFWS 2014).

Human activities that diminish surface water or degrade streamside (riparian) vegetation urbanization and road construction and use are also significant threats, but particularly where they co-occur in the presence of nonnative species (USFWS 2014).

Management Needs

The creation or restoration of marshes for Yuma clapper rail and creation of cottonwood-willow habitat for southwestern willow flycatcher will benefit the northern Mexican gartersnake. Marsh associated with backwaters that are disconnected from the LCR channel are of higher value to northern Mexican gartersnake than connected backwaters on the LCR and are the preferred type to achieve LCR MSCP conservation goals for this species. Marsh associated with disconnected backwaters are managed to limit non-native predatory species, to the extent practicable.

Existing Management Actions

No existing management actions have been identified for the northern Mexican gartersnake. The AGFD's conservation and mitigation program (CAMP; implemented under an existing section 7 incidental take permit) has committed to either stocking (with captive-bred stock) or securing two populations each of northern Mexican and narrow-headed gartersnakes to help minimize adverse effects to these species from their sport fish stocking program through 2021 (USFWS 2011, Appendix C). Other CAMP commitments include: (1) Developing a gartersnake monitoring, research, and restocking plan to guide CAMP activities to establish or secure populations; (2) developing outreach material to reduce the deliberate killing or injuring of gartersnakes (placed in high angler access areas); (3) ensuring that chemically renovated streams are quickly restocked with native fish as gartersnake prey; (4) conducting a live bait assessment team to develop recommendations to amend live bait management; (5) reviewing and updating outreach programs on the risks to native aquatic species from the transport of nonnative aquatic

species; (6) developing and implementing a public education program on gartersnakes; and (7) working with the New Mexico Department of Game and Fish to examine the roll of escaped rainbow trout from Luna Lake into tributaries to the San Francisco River in supporting narrow-headed gartersnakes.

Recovery Goals

The recovery plan for the northern Mexican gartersnake has not yet been prepared; there are no agency-mandated recovery goals for the northern Mexican gartersnake at this time.

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